A DUAL PARTICLE MESHFREE METHOD

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A brief history of meshfree methods will be presented towards assessing the original hope offered by these techniques for computational continuum dynamics. We will then discuss recent progress in Dual Particle Dynamics (DPD), a spatially staggered meshfree discretization of the strong form. Particular attention will be given to stability, boundary conditions, and neighbor searching. We demonstrate stability for Eulerian kernels resulting from the coupling of linear completeness in spatial derivative estimates and two-step Predictor-Corrector time derivative approximations. Boundary conditions are formulated in a unified and consistent way using constrained MLS fits. Several test problems are shown and conclusions drawn.

Stability of meshfree methods is a critical and unresolved issue. Important recent contributions have come from [1,2,3] after the original identification of the SPH tensile instability [4]. The tremendous appeal of meshfree methods is the hope of treating large deformations in a Lagrangian framework. However, if Eulerian kernels which allow for change of connectivity (acquiring new neighbors) cannot be made stable, much of the appeal is lost. It appears that stability can be maintained for Eulerian kernels if certain rules are followed [3]. Fig. 1 results from a stability analysis of DPD and shows a basin of stability in complex eigenvalue space for a Predictor-Corrector time update scheme. The boundary of the basin defines a curve on which the growth rate of the instability is (to within order δt^2) unity, i.e., stable with no damping. A neighborhood can usually be found that allows for a particle time step to satisfy this condition.

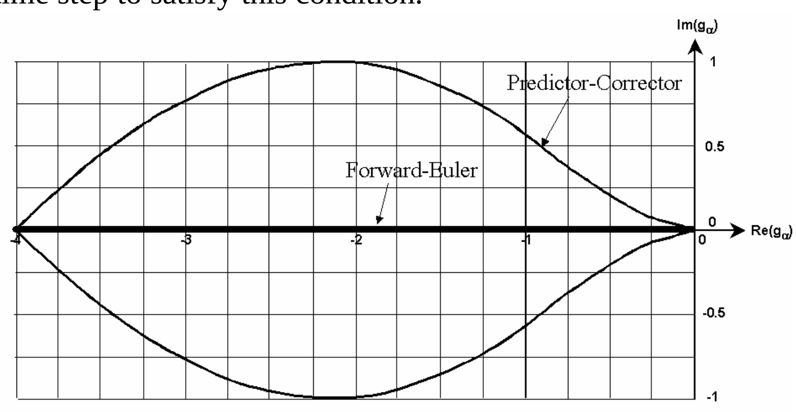

Figure 1. Basins of stability for DPD with Eulerian kernel.

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